

What Is the Penny Buying for South Carolina?

Class Size Reduction in the State

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General Introduction

The Education Improvement Act (EIA) was one of the first in a series of education reform initiatives enacted by the General Assembly. Approved in 1984, the EIA introduced programs to recognize and foster superior performance, identify and improve poor performance, and enhance student achievement. The Legislature supported this reform effort through an increase of one cent in the state sales tax.

One provision of the EIA makes funds available for the evaluation of programs. Another provision requires the State Board of Education to submit an assessment of the Act to the General Assembly by the first of December every year. This year's assessment report evaluates the class size reduction initiative funded by the Education Accountability Act of 1998. Data for this evaluation were collected and raw data files prepared by John M. Swann under an EIA-funded contract with the State Department of Education (SDE). Principal investigator for the project was Wei Yao of the SDE's Office of Research.

Reform initiatives enacted since 1984 expanded and built upon the success of the EIA. During the last generation the list of education reform legislation included

- Education Finance Act (1977),
- Basic Skills Assessment Act (1977),
- Educator Improvement Act (1979),
- Education Improvement Act (1984),
- Target 2000 School Reform for the Next Decade Act (1989),
- Early Childhood Development and Academic Assistance Act (1993),
- School-to-Work Transition Act (1994), and
- Education Accountability Act (1998).

Introduction: Class Size Reduction in South Carolina

Class size reduction (CSR) is an initiative to help schools improve student learning by reducing the number of students in each classroom. Small classes have intuitive appeal to parents, teachers, and the general public. Parents are in favor of reducing class size because they believe it will allow more individualized instruction for their children. Teachers welcome CSR since it allows them to spend more time on instruction and less on classroom management. And although research on the effectiveness of reducing class size provides few consistent answers, twenty-one states have enacted legislation or appropriated funds for limiting the teacher-to-student ratio to twenty or fewer students per teacher. Some of these programs were initiated as early as the 1980s (ERIC Clearinghouse on Educational Management, 2000).

South Carolina enacted legislation for CSR with the Education Accountability Act (EAA) of 1998. This legislation included a section providing funding to school districts choosing to reduce the size of their classes to a 15:1 ratio in grades one through three. Funding for schools in districts designated as impaired or for schools judged as unsatisfactory in the accountability ratings were to receive priority in the distribution of funds. Funding for these schools was to be based on the average daily membership (ADM) in grades one through three. Other school districts were to receive funding based on the number of students eligible for the national free- or reduced-price lunch program. The EAA gives local school boards the flexibility to implement the lower pupil-teacher ratios on a school-by-school, grade-by-grade, or class-by-class basis. Districts implementing the reduced ratios must establish policies to give priority to schools with the highest number of students eligible for free- or reduced-price lunches. Districts choosing to implement the reduced class size must track the students served in classes with a 15:1 ratio for three years so that the impact of smaller class size can be evaluated. The EAA also charges the SDE to develop a plan for evaluating the impact of this initiative (S.C. Code Ann. § 59-63-65). Over the last three years, \$89.3 million has been allocated to reduce the student-teacher ratio in the targeted grades in South Carolina schools.

The United States Department of Education also funds a reduced class size initiative, the Class-Size Reduction Program. Beginning in fiscal year 1999, the program provided \$1.2 billion to schools nationwide for the hiring of additional teachers to reduce the class size in grades one through three to an average of eighteen students per class. Kindergarten was added to the program beginning with the 2000 fiscal year. South Carolina was allocated approximately \$15.7 million from the Class-Size Reduction Program for fiscal year 2000 (United States Department of Education, 2000).

This report serves as a preliminary investigation of the CSR effort in South Carolina. District and school initiatives to reduce class size in South Carolina utilize funds from federal, state, and local sources. This study examined the effects of reduced class size, making no attempt to differentiate the funding sources. It highlights class size status in South Carolina schools before and after the allocation of CSR funds from the EAA. This report includes descriptive information about the characteristics of students in small classes and their performance on standardized achievement tests.

Review of the Literature

The first widely cited studies dealing with evaluating the effectiveness of reducing class size began in the late 1970s. Glass and Smith (1979) synthesized the results from eighty class size research studies. The results led them to conclude that reduced class size can increase academic achievement but that a class size of fifteen or fewer students per teacher would be necessary for a noticeable difference in performance to be seen. Glass, Cahen, Smith, and Filby (1982) also conclude through their research that the most dramatic effects from reducing class size occur when the class has fewer than fifteen students. In 1980, Smith and Glass published a second meta-analysis that examined the nonacademic effects of reducing class size. They found that reduced class size had a positive effect on teacher morale and attitude and on pupil behavior and motivation.

In 1986, Robinson and Wittebols reexamined the Glass and Smith study and its results. They claimed that Glass and Smith had drawn conclusions based on too few studies and that they relied too heavily on individual tutoring research. Robinson and Wittebols then reanalyzed previous studies and postulated that CSR by itself may not result in greater achievement. They claim that reducing class size has varying effects depending upon grade level, subject area, teaching practices, student achievement level, and student characteristics. Ellis (1985) and Mitchell, Beach, and Badarak (1989) reviewed the research and also support this conclusion. Robinson and Wittebols found consistent research indicating that reducing class size with disadvantaged or minority students improves academic performance. Similar increases in performance were noted for low-achieving students in small classes. Their examination of studies by grade level and subject area produced mixed results, however.

When examining the relationship between class size and teaching practices, Robinson and Wittebols found that the climate was more favorable in smaller classes. They also found that even though teachers reported changing their instructional approaches when class sizes were reduced, observational data did not support the teachers' claim. Other researchers have come to similar conclusions. Shapson, Wright, Eason, and Fitzgerald (1980) reported that teachers felt they made changes in their instructional strategies in small classes but that trained observers found little evidence of such changes. Betts and Shkolnik (1999) found teachers did little to alter their instructional strategies but did tend to spend more time on review of material. Finn and Achilles (1999) concluded that teachers do not necessarily change the way they teach but do have more time to better implement their strategies.

In 1990, Robinson found that CSR produced positive effects on student achievement in mathematics and reading as well as student behavior and attitude. These effects were most prominent in kindergarten through grade two and in classes with twenty-two students or fewer per teacher. Robinson also found consistent results across research studies indicating that students who are minorities or are economically disadvantaged demonstrate better academic performance in small classes. Robinson then concluded that the positive effects on achievement that are realized by reducing class size decrease as the grade level of the students increases. He considers one-to-one tutoring for some portion of the day more effective than CSR, with more sustained effects.

Slavin (1986) also critically reviewed Glass and Smith's 1979 study and concluded that class size would have to be reduced to a 3:1 ratio in order for student learning to be impacted. In agreement with Robinson's 1990 research, Slavin states that even more dramatic effects result from one-to-one tutoring. Slavin (1989) also reviewed eight well-designed studies and found that substantial reductions in class size have a small positive effect on student learning. He concluded that long-term studies show the effects are not cumulative across grades and may disappear over the years.

The first true experimental study of the effect of reduced class size on student learning was conducted in Tennessee from 1985 to 1989. The Tennessee STAR (Student-Teacher Achievement Ratio) Project required schools to track students and keep them in the same-sized classes for four years (kindergarten through grade three). There were three class conditions in the experimental design: small classes were to have between thirteen and seventeen students, regular-sized classes were to have between twenty-two and twenty-five students, and regular-sized classes (twenty-two to twenty-five students) with a teacher's aide. Students and teachers were randomly assigned to class size treatments. Each school in the study (n=79) had at least one classroom of each type, a within-schools design. Schools in the sample were balanced for geographic location (inner city, suburban, urban, and rural). The total sample consisted of 6,500 students. Schools in the study received funding for additional teachers and aides but not for additional classrooms. No new textbooks or curricula were to be introduced, and teachers were not to receive additional staff development or training beyond that provided to other teachers during the years of the study (Word et al., 1990; Mosteller, 1995).

Many outcome measures were collected annually from the STAR schools. Achievement measures were drawn from standardized-test data, both norm-referenced and criterion-referenced, or curriculum-based. A self-concept and motivation survey was administered to assess student attitude and engagement. STAR schools also tracked the attendance of teachers and students, student discipline referrals, and student retention rates. Researchers studied the educational background and experience level of teachers and aides, the instructional methods used, and the level of teacher morale. Information was also gathered from teacher and aide interviews, questionnaires, classroom observations, and time logs (Finn & Achilles, 1999).

Results from the study were reported for both the effects of reduced class size on student achievement and the effects on teacher and student attitude and behavior. Achievement differences between students in small classes and those in regular classes or regular classes with an aide were highly significant. A comparison of the achievement scores for students from regular-sized classes revealed no significant advantage in using a teacher's aide. Data were disaggregated by gender and ethnicity and by the geographic location and socioeconomic level of the school. There were significant results for small classes in every cell, leading the researchers to conclude that the positive impact of small class size generalized across school environments (Finn, 1998; Mosteller, 1995). However, they did find that the groups realizing the greatest advantage from small class size were minority and inner-city students. In fact, the effect sizes reported for minority students were double that of nonminority students (Finn & Achilles, 1999). Differences in passing rates between minority and nonminority students were reduced from 14.3 percent to 4.1 percent, resulting in a substantive reduction in the achievement gap (Achilles, Nye, Zaharias, & Fulton, 1996; Finn & Achilles, 1990; Finn, 1998).

Results for student attitude and behavior were somewhat mixed. Researchers did not find significant results on the student self-concept and motivation survey (Word et al., 1990; Finn, 1998). But in the qualitative data obtained through teacher interviews, logs, and classroom observations, researchers found an impact on student behavior. Students initiated more contact with the teacher for help and clarification and participated more in class. They were also more task-oriented, with better classroom performance and behavior (Achilles, 1997).

STAR results report that teachers have more time to cover additional basic materials, supplement and enrich instruction, and provide firsthand learning with concrete materials. They were better able to individualize instruction and apply a variety of instructional approaches. Through frequent interaction with students, teachers were better able to monitor understanding of material. Word et al. (1990) reported that more hands-on learning, immediate feedback, and monitoring of student performance occurred in the small classrooms. Other researchers found that teachers were better organized, had higher expectations, and were more effective in obtaining family involvement (Public Schools of North Carolina, 1999; Finn & Achilles, 1999).

Research by Achilles et al. (1996) involved comparing STAR students with a group from twenty-one similar schools in the same districts. They found that the STAR students had lower retention rates but had no significant differences in attendance or discipline referrals at the end of grade three. STAR students were also identified earlier for special education services. The researchers concluded that small classes beginning in kindergarten or grade one seem to prevent later school problems and that interventions in later grades (grades two and higher) have limited remedial value. Finn and Achilles (1999) conducted further analyses of the STAR data and also found a reduction in grade retentions and noted fewer discipline problems.

Another reanalysis of STAR data by Harvey (1994) examined the differences in retention rates between STAR students from different-sized classes. The purpose of the investigation was to see if reduced class size raises the achievement scores of kindergarten and first grade students who have been retained. Results showed that retained students performed better in regular classes and performed even better in regular classes that had teacher aides. Harvey concludes that small classes have no remedial effect.

Information from the STAR study led researchers to conclude that student performance in primary grades may be increased by CSR without the introduction of new materials or curricula and without training teachers (Finn, Fulton, Zaharias, & Nye, 1989). However, Finn and Achilles (1999) caution that teacher quality explains most of the differences in student performance.

Phase two of the STAR study, the Lasting Benefits Study, was initiated in 1989 and continued through 1997. During this phase, investigators tracked a subsample of STAR students through their return to regular-sized classrooms in fourth grade and followed them through sixth grade. Students were rated by teachers on their effort, initiative taking, and nonparticipatory behavior. Mosteller (1995) found that students from small classes continued to perform better than students from larger classes, even after returning to regular-sized classrooms. Significant results were reported through seventh grade. Finn (1998) also found higher achievement levels in all areas. Finn, Gerber, Achilles, and Boyd-Zaharias (2000) reported that students were better behaved and were rated as expending more effort and taking more initiative. The greatest effects were

reported for students who had been in small classes for the four years from kindergarten through grade three. The researchers concluded that one year in a small class is not long enough to produce long-term effects.

Nye and Hedges (1999) also matched STAR students from grade three to grade eight and found that while small class size effects may diminish, they are still statistically and practically significant. The researchers report that students having more years in a small class have higher levels of achievement five years later than students who had fewer years in small classes.

A further follow-up study conducted by Boyd-Zaharias and Pate-Bain in 2000, showed that STAR students were more likely to graduate on time and receive an honors diploma. The study followed STAR students to graduation and found that STAR students in small classes had higher grades and were retained less often than the students in regular classes and regular classes with an aide. STAR students also took more foreign language courses, had higher grade point averages and higher graduation rates, and were more likely to go to college.

The third phase of the STAR study, Project Challenge, was also conducted between 1989 and 1997. This follow-up study used seventeen of the poorest school districts in Tennessee. Finn (1998) and Mosteller (1995) found that these seventeen districts increased their ranking from well below average to above average on statewide achievement tests in reading and math. During the second and third year of this follow-up study, teacher training was provided for fifty-seven teachers who were blind to their assignment to small or regular classes. They did not obtain a separate effect on student performance beyond that resulting from reduced class size.

Many researchers have reexamined the STAR study and follow-up research, raising several points of concern. Finn and Achilles (1990) and Sanogo and Gilman (1994) objected to the fact that the schools participating in the study were volunteer schools and not randomly selected or representative of the state of Tennessee. These schools were larger than the state average in order to meet the within-school design requirements. They also had slightly higher per-pupil expenditures and teacher salaries. However, STAR schools average scores in reading and math were below the state average. Finn and Achilles (1990) and Illig (1996) both noted that the STAR study used only one-third of the original sample in the longitudinal analysis. Mosteller (1995) reports that providing in-service training to only fifty-seven teachers in the Project Challenge study may have confounded the class size results. Finally, Finn and Achilles (1990) state that teacher and student expectations likely biased the results. Knowledge of being in a treatment or control group may have influenced students and teachers to make improvements (i.e., the Hawthorne effect).

Hanushek (1999) states that nonexperimental evidence (e.g., historical achievement test data, school demographic information) uniformly shows no consistent improvement in achievement from reduced class size. He cites numerous flaws in the STAR study that could have biased the results and rendered significant effects. First, class size designations were not strictly maintained throughout the duration of the study. Some students in regular classes or in regular classes with an aide were moved to small classes. The students who switched designations were not removed from the analysis but were counted as students from regular-sized classes. Secondly, there was no pretest data on achievement to control for classroom differences prior to the treatment.

Finally, teacher quality was not randomized across classrooms. In fact, Hanushek notes a total lack of detail on teacher characteristics from the STAR study.

Several authors have examined Hanushek's work and found problems with his analyses. He uses pupil-teacher ratios instead of classroom teacher-to-student ratios. These figures are not analogous (Finn, 1998; Bracey, 1999). Pupil-teacher ratios are calculated across the school (number of students divided by the number of teachers) and are lowered by the number of teachers and other professionals that are not teaching self-contained classes. Class size is the number of students in a classroom with a teacher. Finn and Achilles (1999) state that pupil-teacher ratio is not strongly related to student academic achievement but class size ratio is.

Another large-scale study examining the effects of CSR was conducted in Indiana from 1984 to 1987. Project Prime Time was a small-scale study that was not well designed. There were no controls for equating classes, and the only evaluation was conducted through subjective observations (Sanogo & Gilman, 1994). Achievement test results were not comparable since the study used different tests across schools. The researchers defined small classes as eighteen to one or lower, but since they used the pupil-teacher ratio, many classes had up to thirty-one students. Some students were not even in small classes all day (Finn, 1998). Teachers were specifically selected for the study but received no training on instructional strategies for small classes (Sanogo & Gilman, 1994).

When examining the effects from Project Prime Time, Bain and Achilles (1986) found that students in smaller classes (with a ratio less than 14:1) scored higher on standardized tests and had fewer behavioral problems. Teachers of the smaller classes reported that they were more satisfied, efficient, and productive and were better able to individualize instruction. Students were reported as being better behaved and spending more time on-task. Other Project Prime Time researchers reported gains in standardized test scores in grades one and two but noted that the effects were small and had virtually disappeared by the third grade (Sanogo & Gilman, 1994). Gilman and Tillitski (1989) concluded that students who had been in Prime Time classrooms for three years did not achieve a level of academic performance higher than that of the students who had been instructed in large classes for three years. The researchers also report that they found little effect from reducing class sizes ratios from 26.9:1 to 19.1:1.

Wisconsin also administered a large-scale study on reduced class size. This study, referred to as the Student Achievement Guarantee in Education (SAGE), was conducted from 1996 through 2000. This quasi-experimental study was targeted on schools with high levels of poverty. Thirty schools were SAGE schools with an average class size of between twelve and fifteen students per teacher. There were fourteen to seventeen comparison schools with similar student and school characteristics. These comparison schools had an average class size of between twenty-one and twenty-five students. Implementation of CSR occurred in existing classrooms and was accompanied by the following interventions: a rigorous curriculum, before- and after-school activities, professional development, and an accountability system. However, only reduction in class size was implemented uniformly across all SAGE schools (CERAIO, 2000; Molnar et al., 1999).

Outcome measures included standardized test scores, which were used to compare student performance between SAGE and comparison schools. Qualitative evaluations were completed through classroom observations, interviews, and questionnaires for teachers and principals. Questionnaires for the teachers asked for their perceptions of the impact SAGE participation had on teaching, curriculum, family involvement, and professional development. They were also asked to indicate their overall satisfaction with the SAGE program. Principals were asked to rate teaching, the development of a rigorous curriculum, professional development opportunities, and the effects of before- and after-school activities. They were also asked to describe teacher enthusiasm and student engagement. Teachers were asked to assess each student's level of participation in the class and to keep an activity log for recording classroom events such as time spent on various activities, specific content, and student learning. Additional analysis involved classroom observational studies that compared the teaching behaviors of highly effective SAGE teachers (those with high-achieving students) and less effective SAGE teachers (those with low-achieving students) (CERAIO, 2000).

For the purpose of analyzing the effects of reduced class size, first-grade students were pretested in October and posttested in May. Control variables were socioeconomic status, absenteeism, and ethnicity. The SAGE students scored significantly higher than the comparison students on all but reading achievement scores. Posttesting of the same students again at the end of second and third grades showed maintenance of the effect but no additional improvement. As in the Tennessee STAR study, minority SAGE students outperformed minority comparison-group students. African-American SAGE students scored lower than comparisons on the pretest but scored significantly higher on the posttest. These higher gain scores demonstrate a closing of the achievement gap (CERAIO, 2000).

Researchers also examined the within-classroom effects of teacher experience, student participation, and class configuration. Different types of classroom organizations were used across the schools in the study to achieve small class size. Some students were in small classes for only half of the day. Others had large classes with two teachers. Case studies were conducted in three schools to assess the effect of different classroom configurations. Molnar et al. (1999) found no statistically significant relationship between different classroom organizational patterns and achievement. Molnar et al. also concluded that membership in SAGE was a significant predictor of student achievement. In fact, they interpreted the effect as such, for each additional student over fifteen in a class a 0.29 to 1.17 decrease in posttest scores results. However, the researchers found that the number of years in a SAGE program was not a significant predictor of achievement scores. In addition, SAGE interventions beyond CSR (rigorous curriculum, before- and after-school activities, and professional development) did not impact student achievement.

Results from qualitative analyses showed that SAGE students from smaller classes had fewer discipline requirements, a situation allowing more time to be spent on direct instruction and active teaching. There was also more time for teaching because of the reduction in paperwork. Teachers were able to individualize instruction, diagnose and monitor student progress, and cover more content in greater depth. They were also more enthusiastic and less stressed. Students spent more time on-task, participated more in class discussions, and were more engaged (Molnar et al., 1999).

An additional analysis was undertaken to determine the differences between highly effective SAGE teachers (those with high-achieving students) and less effective SAGE teachers (those with low-achieving students). Information was gathered from classroom observations and descriptive analyses of teaching strategies. Results of this analysis show that teachers with higher-achieving students spent more time on individualization of instruction. They focused on basic skills and drill and practice in addition to hands-on and experiential activities. They also set clear and consistent goals for students and rules for classroom management (CERAIO, 2000).

Molnar et al. (1999) noted several flaws with the SAGE study, including the lack of guidelines or standards for a rigorous curriculum. There were no clear instructional objectives for the before- and after-school programs or for professional development activities. In addition, comparison schools were not strictly comparable. SAGE schools had fewer minority students across all ethnic categories (the total sample included only a 25 percent minority population) but had more special-needs students and more qualifying for the free- or reduced-price lunch program. The researchers also noted that SAGE schools were significantly larger than the comparison schools. Yet they found no significant differences between SAGE and comparison schools on pretest scores.

As this summary of the research on the effects of reduced class size on student performance suggests, there are still some unanswered questions about whether CSR alone can impact student achievement. Many researchers point to other variables that are more likely than CSR to cause an impact (Robinson & Wittebols, 1986; CERAIO, 2000; Ellis, 1984; Finn & Achilles, 1999). Even so, the widespread acceptance of this intervention is at least partially based on its popular appeal to parents and teachers. As researchers, we must not focus the evaluation of CSR results solely on standardized achievement test results. Broader evaluation criteria including qualitative measures do show many consistent benefits. For example, teachers are more satisfied, spend less time on classroom management, and are better able to focus on individualizing instruction to deal with students' strengths and weaknesses. Students are more engaged, participate more in class, and are less disruptive. These outcomes may be worth the investment even if achievement test scores show only small gains. In fact, we may be ill advised to place emphasis on standardized achievement test scores for students in early grades, given the persuasive guidelines from the National Association for the Education of Young Children (NAEYC, 1987).

We also need to weigh the costs and benefits of CSR in comparison to other instructional strategies and techniques. Although the costs for CSR may be astronomical (not to mention the difficulty in finding adequate classroom space and qualified teachers), they may be worth it if states realize savings from fewer special education referrals, grade retentions, dropouts, remediation needs, and discipline problems. We also need to consider the very real possibility that small classes may limit the valuable learning experiences that result from peer interaction and group work. For maximum impact, CSR should be incorporated with innovative instructional strategies. We cannot expect substantial increases in student achievement if teachers use the same instructional methods they use with large classes.

Methodology

Limitations to the Study

This study was conducted as a preliminary analysis of the status of CSR in South Carolina. For the following reasons, it should be interpreted with caution:

- Statewide student achievement test scores were not available for grades one and two. The analysis in this report relied on a very limited sample of nine school districts that were not randomly selected nor guaranteed to be representative of the state. Student achievement data for grade three and demographic information related to student participation in different-sized classes were reported for the whole state.
- Students who were identified as being from classes of five students or fewer were considered to be in special education pullout programs and therefore were excluded from all analyses.
- There was no information available about the professional development activities, instructional materials and strategies, and curriculum revisions that were conducted across the State in different-sized classes. The results of any training efforts may readily explain observed differences between groups, further confounding the analysis of CSR effects.
- State guidelines for the implementation of CSR were unavailable. Therefore, each school district could implement the initiative uniquely to best serve local needs and considerations.
- The students placed in small-sized classes were most likely overrepresentative of low-income, at-risk students since the legislation required districts to target these students in selection.

A comprehensive evaluation of the effectiveness and impact of CSR efforts will require resolution of these flaws in design and implementation.

Research Strategy

A retrospective ex post facto study was conducted. The analyses utilized intact groups of students in grades one through three. Historical student demographic and achievement test information was examined and reported.

Data Collection

Four sources of data were utilized in addressing the research questions:

- statewide student demographic data from 1997 to 2001;
- student achievement data from the Metropolitan Achievement Tests, Seventh Edition (MAT-7), at grades one through three in nine school districts for spring 1997, 1998, and 1999;¹

¹ The nine school districts were Aiken, Bamberg Two, Barnwell Forty-Five, Clarendon Two, Dillon One, Kershaw, Orangeburg Five, Saluda, and Williamsburg.

- statewide student achievement data from the Palmetto Achievement Challenge Tests (PACT) at grade three in the spring of 1999 and 2000; and
- telephone interview data from directors of elementary education in twenty local school districts.

Data Analyses

Descriptive analyses of student achievement test scores from the MAT-7 and the PACT were conducted by class size and demographics in primary grades from school years 1997–98 through 2000–01. For the purposes of this study, classes with fifteen students or fewer were classified as small, sixteen to twenty-one students as medium sized, and twenty-two or more students as large. The class sizes were identified by calculating student-teacher ratio in homeroom classes from a student demographic file. It should be noted that these calculated class sizes might not be a true representation of the actual class sizes across the State. Student-level class size information was then matched to student achievement test data. Classrooms consisting of five or fewer students were assumed to be special needs pullout programs and were excluded from this investigation. Students with disabilities and students with missing homeroom teacher data were also excluded from the analyses. Average achievement test scores from the MAT-7 sample at grades one and two and statewide for the PACT at grade three were then analyzed by class size and student demographic characteristics.

Statistical analyses of the significance of student performance differences by class size in the targeted grades were conducted. These results are available upon request from the SDE's Evaluation Section, Office of Research.

Research Questions

1. What were the demographic characteristics of students in different-sized classes in grades one through three prior to and following the CSR initiative? (Statewide data, 1997–98 and 2000–01 school years.)

This question will further examine the following components:

- student-teacher ratio in grades one to three for the 1997–98 and the 2000–01 school years,
 - percentage of students served in different-sized classes from grade one to three from 1997–98 to 2000–01,
 - percentage of different-sized classes from grade one to three from 1997–98 to 2000–01, and
 - student demographic characteristics by different-sized classes in grade one for the 1997–98 and 2000–01 school years.
2. What are the performance differences on the MAT-7 by students from different-sized classes at grade one prior to the CSR initiative? Does student performance differ by gender, ethnicity, or free- or reduced-price lunch eligibility? (Nine districts, spring 1997.)

3. What are the performance differences on the MAT-7 by students from different-sized classes at grade two prior to the CSR initiative? Does student performance differ by gender, ethnicity, or free- or reduced-price lunch eligibility? (Nine districts, spring 1998.)
4. What are the performance differences on the MAT-7 for second-grade students who were enrolled in small classes at grade one and those who were not? (Nine districts, spring 1997 to spring 1998.)
5. What are the performance gains on the MAT-7 from grade one to grade two for students who were in the largest and smallest classes for two years? (Nine districts, spring 1997 to spring 1998.)
6. What are the performance differences on the PACT by students from different-sized classes at grade three after the first year of program implementation? Does student performance differ by gender, ethnicity, or free- or reduced-price lunch eligibility? (Statewide data, spring 1999.)
7. What are the performance differences on the PACT at grade three by students who were enrolled in the same-sized classes from grade one (1997–98) to grade two (1998–99) in the second year of the CSR initiative? Does student performance differ by gender, ethnicity, or free- or reduced-price lunch eligibility? (Statewide data, spring 2000.)
8. After the second year of the CSR initiative, what percent of students from different class sizes performed at or above basic on the PACT at grade three and were enrolled in the same-sized classes in grade one (1997–98) and in grade two (1998–99)? (Statewide data, spring 2000.)
9. What are the student performance gaps on the third-grade PACT between large and small classes by ethnicity and free- or reduced-price lunch eligibility? (Statewide data, spring 1999 and spring 2000.)

Findings

1. *What were the demographic characteristics of students in different-sized classes in grades one through three prior to and following the CSR initiative? (Statewide data, 1997–98 and 2000–01 school years.)*

Student-Teacher Ratio

Over the three years since funds for CSR were appropriated, the estimated statewide average class size has fallen by three students in grade one, by one student in grade two, and two students in grade three (see figure 1).

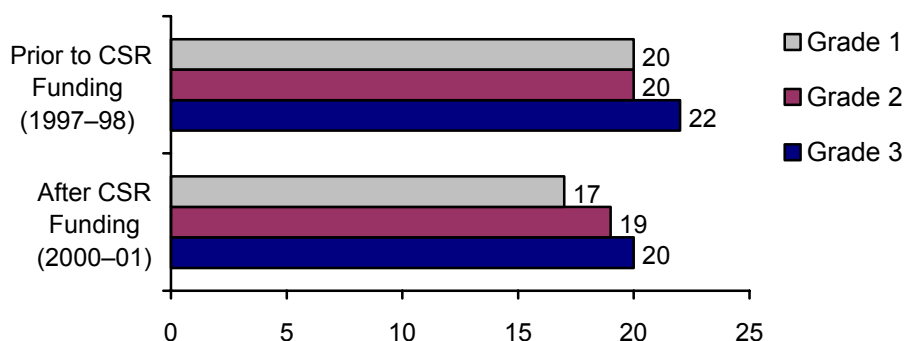


Figure 1. Estimated average class size in grades one to three prior to and after funding of the class size reduction (CSR) initiative.

Percentage of Students Served in Different-Sized Classes

A comparison across grades reveals that class sizes tend to increase as students progress from grade one through grade three. This increase occurred both before and after the funding of the CSR initiative. Table 1 displays the percentage of students in the varying class sizes in 1997–98 and 2000–01 statewide. Third-grade students were most likely to be taught in classrooms with twenty-two students or more. As shown in table 1, 38 percent of third graders were still enrolled in classes with more than twenty-two students in the 2000–01 school year. The first grade shows the greatest increase in the number of students in small classes. In 1997–98, only 5 percent of first-grade students were in small classes. In 2000–01, 35 percent of first graders were in classes with fifteen or fewer students.

TABLE 1

Percentage of Students by Class Size before and after the Funding of
the Class Size Reduction (CSR) Initiative

Grade	Class Size	Before CSR (1997–98 School Year)	After CSR (2000–01 School Year)
Grade 1		(n=48,931)	(n=50,156)
	22 or more students	31%	12%
	16 to 21 students	64%	53%
	15 or fewer students	5%	35%
Grade 2		(n=42,688)	(n=50,334)
	22 or more students	35%	25%
	16 to 21 students	59%	62%
	15 or fewer students	6%	13%
Grade 3		(n=47,659)	(n=51,667)
	22 or more students	56%	38%
	16 to 21 students	40%	52%
	15 or fewer students	4%	10%

Note. Classes with five students or less were considered to be pullout programs for special education and were excluded.

Percentage of Different-Sized Classes

The percentages of classes statewide differentiated by the size of the class are displayed in table 2. Grade one experienced the most striking change in class size before and after the CSR initiative funding. The number of small-sized classes in first grade in South Carolina quadrupled from 254 classrooms in 1997–98 to 1,282 classrooms in 2000–01. This increase clearly demonstrates that schools are implementing CSR in grades one through three and most dramatically in grade one.

TABLE 2

Estimated Percentage of Classes by Size before and after the Funding of
the Class Size Reduction (CSR) Initiative

Grade	Class Size	Before CSR (1997–98 School Year)	After CSR (2000–01 School Year)
Grade 1		(n=2,544)	(n=2,914)
	22 or more students	25%	6%
	16 to 21 students	65%	50%
	15 or fewer students	10%	44%
Grade 2		(n=2,212)	(n=2,608)
	22 or more students	29%	18%
	16 to 21 students	60%	63%
	15 or fewer students	11%	19%
Grade 3		(n=2,273)	(n=2,501)
	22 or more students	50%	30%
	16 to 21 students	43%	55%
	15 or fewer students	7%	15%

Note. Classes with five students or less were considered to be pullout programs for special education and were excluded.

Student Demographic Characteristics, Grade One

Since the majority of students in reduced classes are first graders, table 3 displays the student demographic information for first-grade classes statewide. Even before the initiative to reduce class size in the early grades was funded, many at-risk first-grade students (as measured by eligibility for the free- or reduced-price lunch program) were taught in smaller class settings. In 1997–98, 71 percent of the first-grade students statewide who were eligible for the free- or reduced-price lunch program were taught in classrooms with fifteen or fewer students. There was also an increase in the number of students not eligible for free- or reduced-price lunch who were placed in small classes after the implementation of CSR (from 29 percent to 37 percent).

The percentage of boys and girls in the different-sized classes was virtually unchanged from 1997–98 to 2000–01. However, the percentage of whites in large classes increased by 9 percentage points over the same time period.

TABLE 3

First-Grade Student Population Characteristics by Class Size
before and after the Funding of the Class Size Reduction (CSR) Initiative

Student Population Characteristics				
Class Size	Before CSR (1997–98 School Year)		After CSR (2000–01 School Year)	
	n=48,931		n=50,156	
	<u>Female</u>	<u>Male</u>	<u>Female</u>	<u>Male</u>
22 or more students	49%	51%	48%	52%
16 to 21 students	48%	52%	48%	52%
15 or fewer students	46%	54%	48%	52%
	<u>Nonwhite</u>	<u>White</u>	<u>Nonwhite</u>	<u>White</u>
22 or more students	45%	55%	36%	64%
16 to 21 students	48%	52%	45%	55%
15 or fewer students	58%	42%	54%	46%
	<u>Eligible for Free/Reduced- Price Lunch</u>	<u>Not Eligible for Free/Reduced- Price Lunch</u>	<u>Eligible for Free/Reduced- Price Lunch</u>	<u>Not Eligible for Free/Reduced- Price Lunch</u>
22 or more students	54%	46%	45%	55%
16 to 21 students	58%	42%	54%	46%
15 or fewer students	71%	29%	63%	37%

Note: Nonwhites include African-Americans, Hispanics, Asians, Pacific Islanders, and Native Americans.

2. *What are the performance differences on the MAT-7 by students from different-sized classes at grade one prior to the CSR initiative? Does student performance differ by gender, ethnicity, or free- or reduced-price lunch eligibility? (Nine districts, spring 1997.)*

Data used to address questions 2 through 5 were drawn from nine districts that administered the MAT-7 in the spring of 1997 and 1998. Students from the nine districts were matched to statewide student demographic information to obtain their lunch status designations. Refer to the appendix for additional trend information on MAT-7 percentages from 1997 through 1999.

As shown in figure 2, first-grade students taught in classes with fifteen or fewer students had higher mean scores on the MAT-7 reading and math than students from other size classes. In fact, in all of the disaggregations, students in smaller classes scored higher on average than students in medium or large classes.

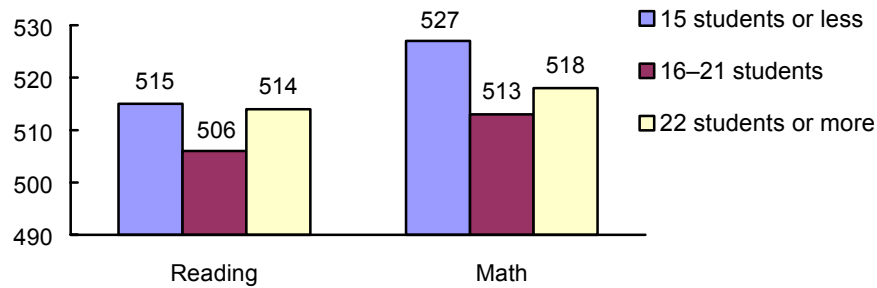


Figure 2. First-grade average MAT-7 scaled scores in reading and math by class size prior to class size reduction (CSR) initiative funding, spring 1997 (n=3,121).

Female students from all class sizes scored higher than male students on reading and math, except in large-sized math classes (see figure 3).

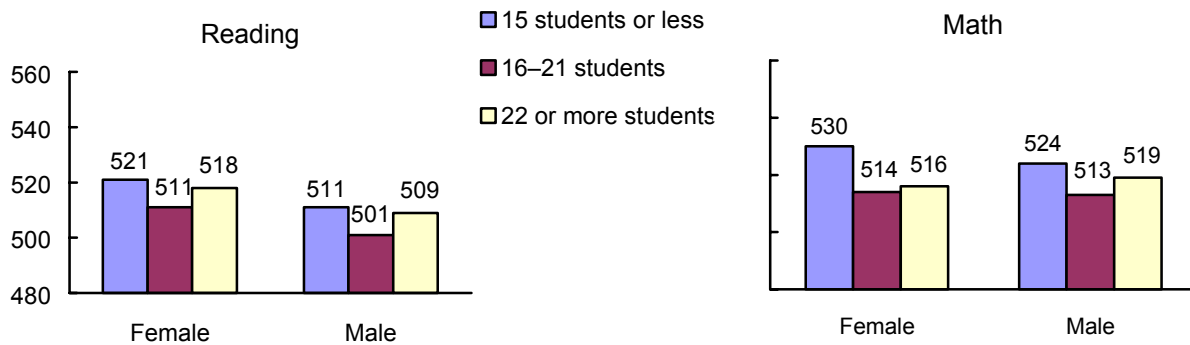


Figure 3. First grade average MAT-7 scaled scores in reading and math by class size and gender prior to class size reduction (CSR) initiative funding, spring 1997.

As shown in figure 4, white and nonwhite children from small classes scored higher than children from larger classes.

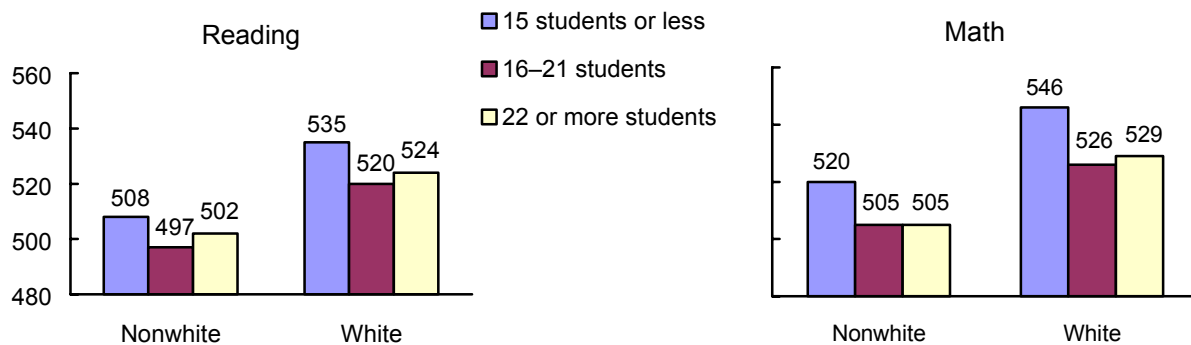


Figure 4. First grade average MAT-7 scaled scores in reading and math by class size and ethnicity prior to class size reduction (CSR) funding, spring 1997.

The data for children who received free- or reduced-price lunch show that children from classes with fifteen or fewer students had higher average scores on both reading and math than those who were in the medium-sized or large classes (see figure 5).

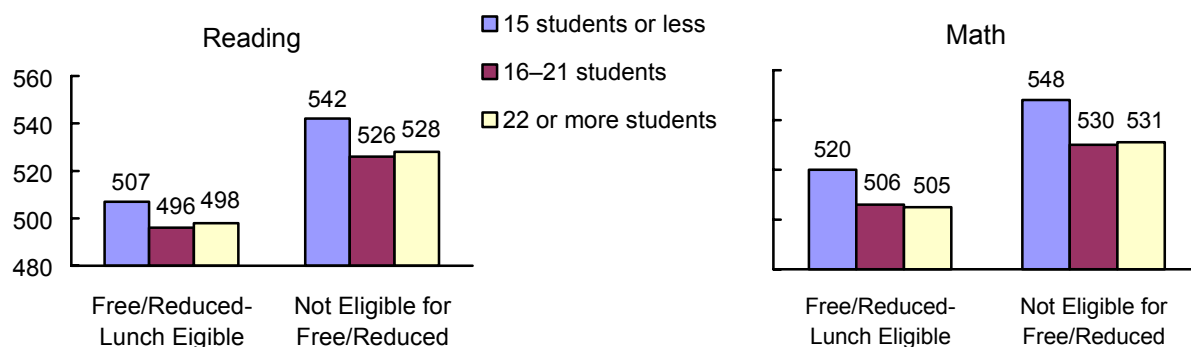


Figure 5. First-grade average MAT-7 scaled scores in reading and math by class size and eligibility for the free- or reduced-price lunch program prior to class size reduction (CSR) funding, spring 1997.

3. *What are the performance differences on the MAT-7 by students from different-sized classes at grade two prior to the CSR initiative? Does student performance differ by gender, ethnicity, or free- or reduced-price lunch eligibility? (Nine districts, spring 1998.)*

As shown in figure 6, children from classes with sixteen to twenty-one students in grade two scored higher on the MAT-7 reading and math than students from the smallest or largest classes.

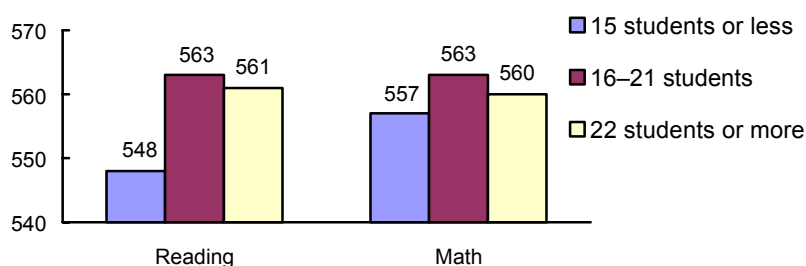


Figure 6. Second grade average MAT-7 scaled scores in reading and math by class size prior to class size reduction (CSR) initiative funding, spring 1998 (n=3,794).

Female students tended to have higher mean scores on reading in all three class size designations. When math performance was compared, not only female students from medium-sized classes but also those from the smallest classes had higher average scores than male students in the same-sized classes (see figure 7).

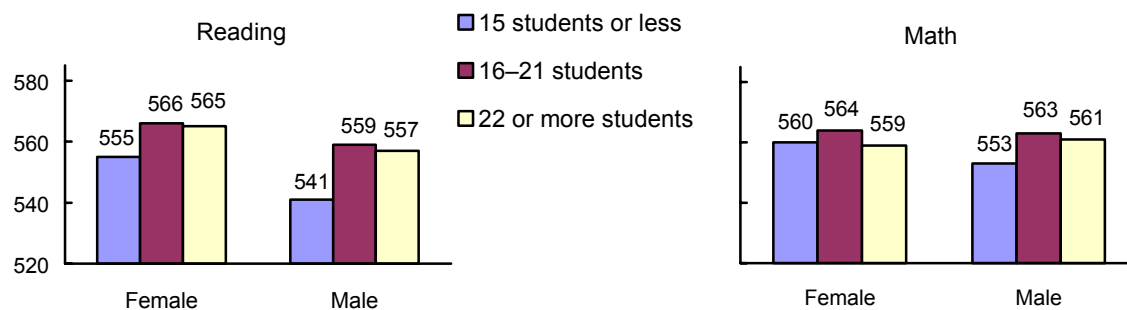


Figure 7. Second-grade average MAT-7 scaled scores in reading and math by class size and gender prior to class size reduction (CSR) initiative funding, spring 1998.

Among nonwhite students, those who were in the small classes averaged higher scores on math at grade two than the nonwhite students who were in larger classes (see figure 8).

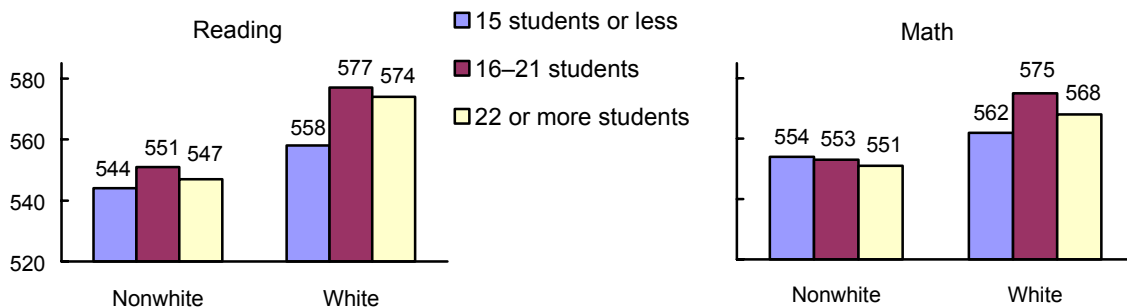


Figure 8. Second grade average MAT-7 scaled scores in reading and math by class size and ethnicity prior to class size reduction (CSR) funding, spring 1998.

For students eligible for free- or reduced-price lunch, those in the small classes had higher average scores on math (556) than the students from the medium-sized (553) and large classes (552) (see figure 9).

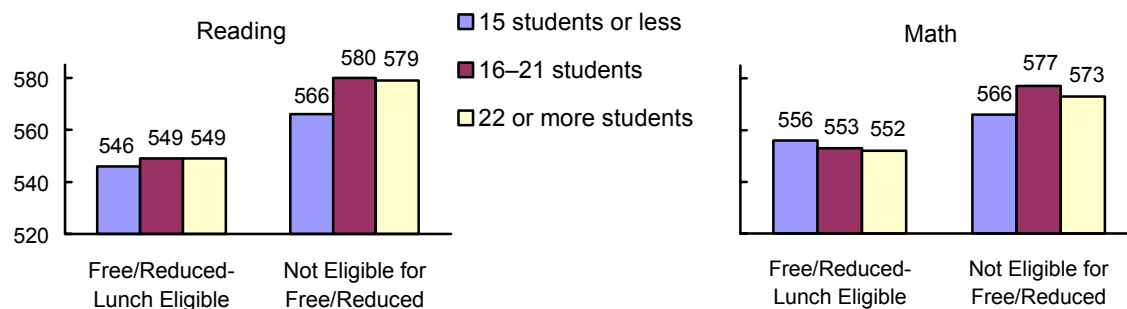


Figure 9. Second grade average MAT-7 scaled scores in reading and math by class size and eligibility for the free- or reduced-price lunch program prior to class size reduction (CSR) funding, spring 1998.

4. *What are the performance differences on the MAT-7 for second-grade students who were enrolled in small classes at grade one and those who were not? (Nine districts, spring 1997 to spring 1998.)*

This longitudinal analysis shows that when students had been enrolled in small classes at grade one, they had higher average MAT-7 scores on both reading and math at grade two (see figure 10).

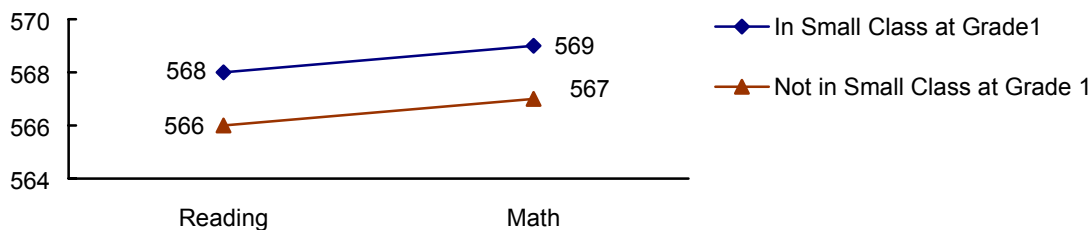


Figure 10. Second grade average MAT-7 scaled scores in reading and math between children who were in a small class at grade one and those who were not, spring 1998 (reading, n=1,877; math, n=1,885).

5. *What are the performance gains on the MAT-7 from grade one to grade two for students who were in the largest and smallest classes for two years? (Nine districts, spring 1997 to spring 1998.)*

In figure 11, students who were enrolled continuously in the same-sized classes for two years are compared by average scaled score gains on the MAT-7 from grade one to grade two. This analysis was limited to comparing students from small and large classes.

Students who were enrolled in the smallest classes (fifteen or fewer students) for two years had larger gains in both reading and math from grade one to grade two.

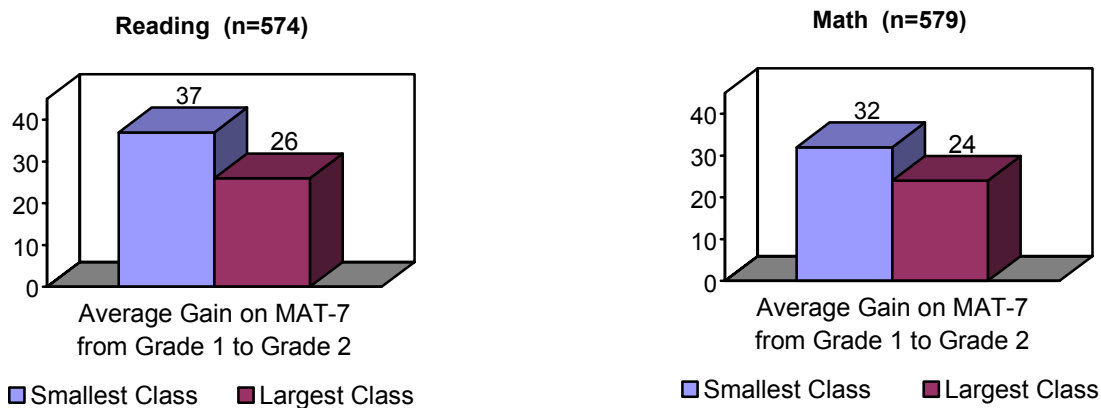


Figure 11. Average scaled score gains on the MAT-7 from grade one to grade two by students in smallest and largest classes, spring 1997 to spring 1998.

6. *What are the performance differences on the PACT by students from different-sized classes at grade three after the first year of program implementation? Does student performance differ by gender, ethnicity, or free- or reduced-price lunch eligibility? (Statewide data, spring 1999.)*

As shown in figure 12, students who were in larger classes in the third grade had the highest average scores on both ELA (English/language arts) and math on the third-grade PACT. This analysis does not control for class size designations in grades one and two.

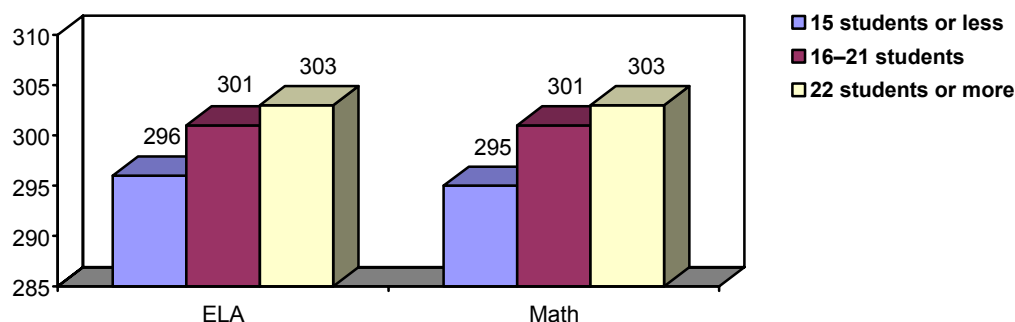


Figure 12. Third-grade average PACT scaled scores by class size, spring 1999 (n=29,531).

At grade three, female students from classes of all sizes performed better on the PACT ELA than male students. Females from small classes also had higher mean scores on math than male students from small classes (see figure 13).

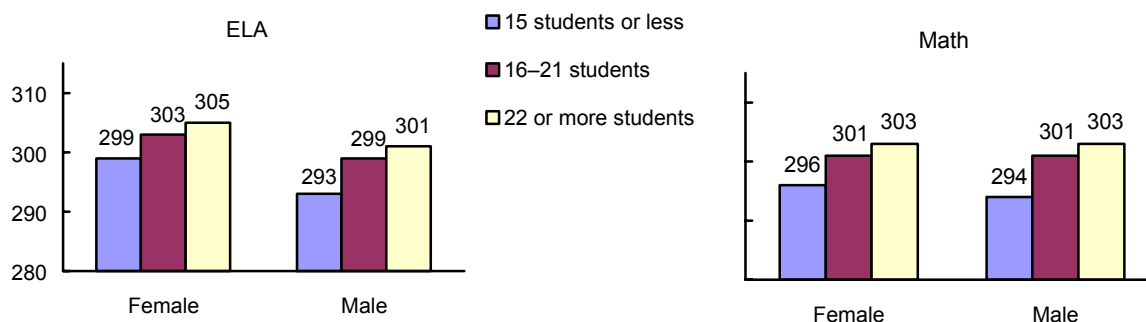


Figure 13. Third-grade average PACT scaled scores by class size and gender, spring 1999.

As shown in figure 14, white and nonwhite students from small classes had lower average scores in both subject areas than students in medium-sized or large classes.

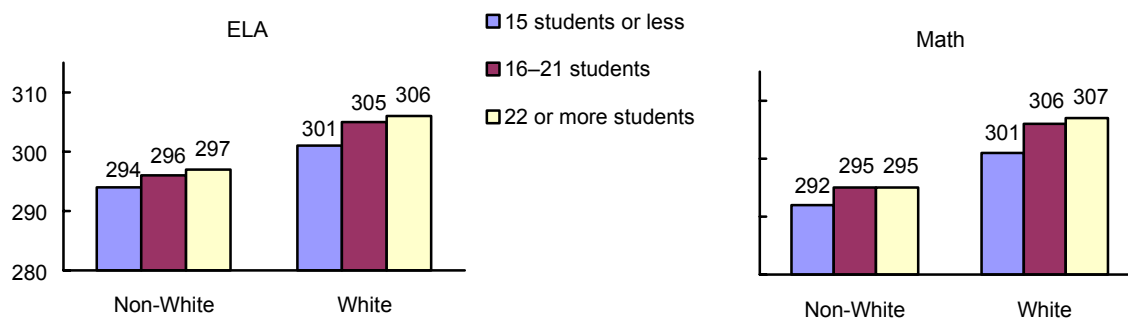


Figure 14. Third-grade average PACT scaled scores by class size and ethnicity, spring 1999.

Students in small classes had lower mean scores in both subject areas regardless of free- or reduced-price lunch eligibility (see figure 15).

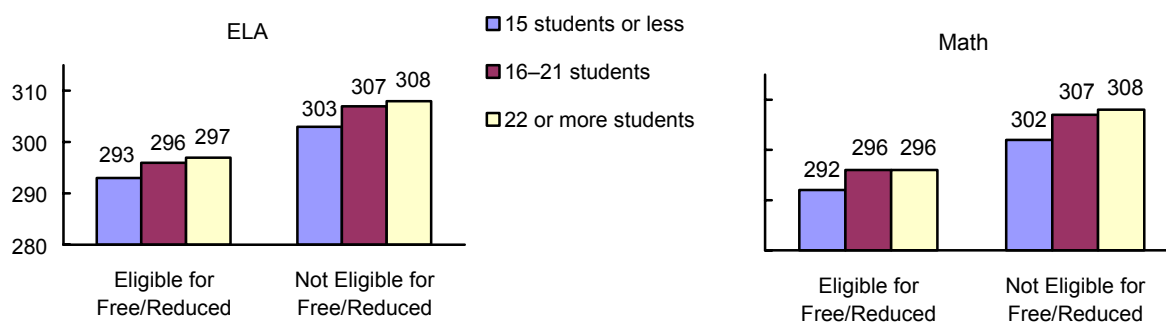


Figure 15. Third-grade average PACT scaled scores by class size and free- or reduced-price lunch eligibility, spring 1999.

7. *What are the performance differences on the PACT at grade three by students who were enrolled in the same-sized classes from grade one (1997–98) to grade two (1998–99) in the second year of the CSR initiative? Does student performance differ by gender, ethnicity, or free- or reduced-price lunch eligibility? (Statewide data, spring 2000.)*

The results of this longitudinal analysis show that students who had been in large classes for two years had the highest mean scaled scores on the third-grade PACT. In fact, as class size increases, average scaled scores on the third-grade PACT increases. This increase occurred in both English language arts (ELA) and math (see figure 16).

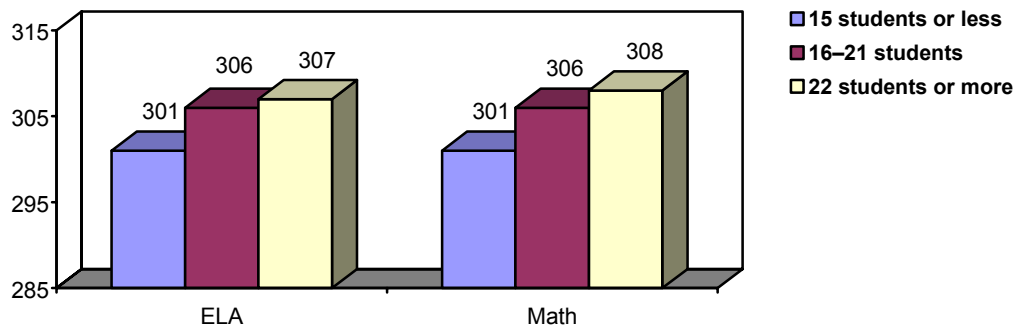


Figure 16. Third-grade average PACT scaled scores by class size, spring 2000 (n=22,895).

As shown in figure 17, female students who stayed in the same-sized class for two years had equivalent or higher average scores on the third-grade PACT than males, across both subject areas.

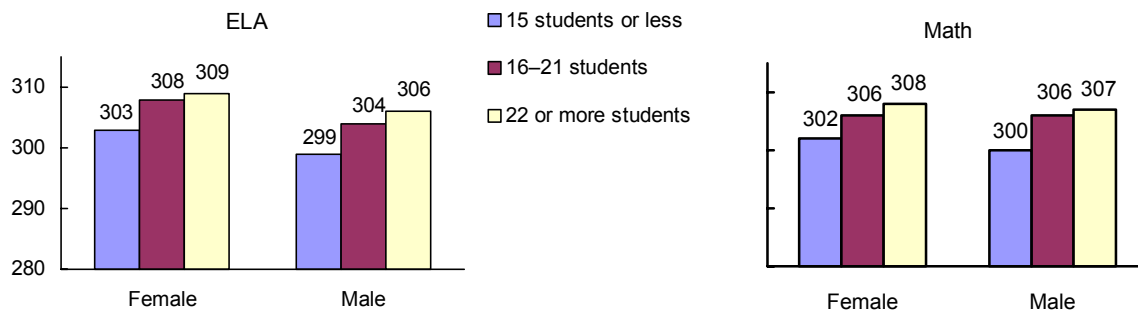


Figure 17. Third-grade average PACT scaled scores by class size and gender, spring 2000.

White and nonwhite students who stayed in small classes for two years had the lowest mean scores on the third-grade PACT in both ELA and math (see figure 18).

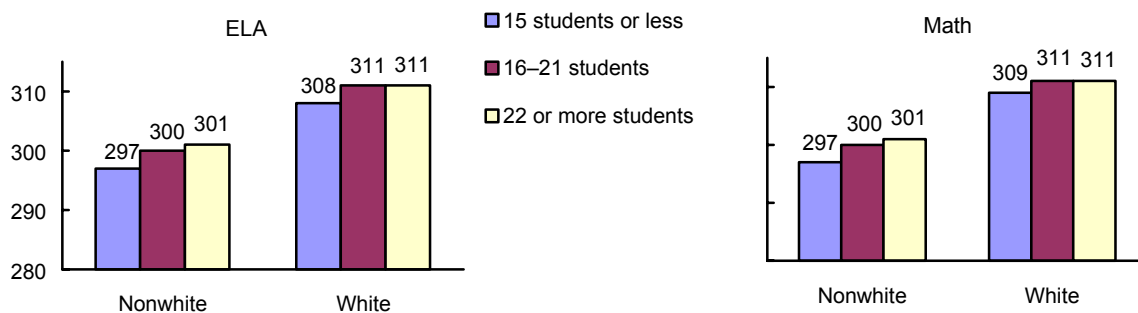


Figure 18. Third-grade average PACT scaled scores by class size and ethnicity, spring 2000.

As shown in figure 19, mean scores for each different class size between lunch groups were virtually identical, suggesting that socioeconomic status is a more important predictor of achievement than class size.

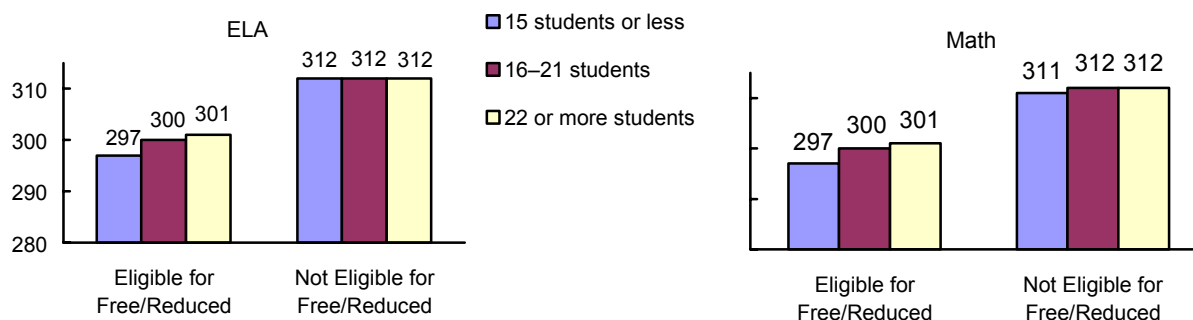


Figure 19. Third-grade average PACT scaled scores by class size and free- and reduced-price lunch eligibility, spring 2000.

8. *After the second year of the CSR initiative, what percent of students from different class sizes performed at or above basic on the PACT at grade three and were enrolled in the same-sized classes in grade one (1997–98) and in grade two (1998–99)? (Statewide data, spring 2000.)*

When calculations were based on the percentage of third-grade students performing at or above basic on the PACT ELA and math by class size, the data again showed that the larger the class, the higher the percentage of students meeting the standard.

The percentage of students at or above basic on math was lower than that for ELA across the three different class designations (see figure 20).

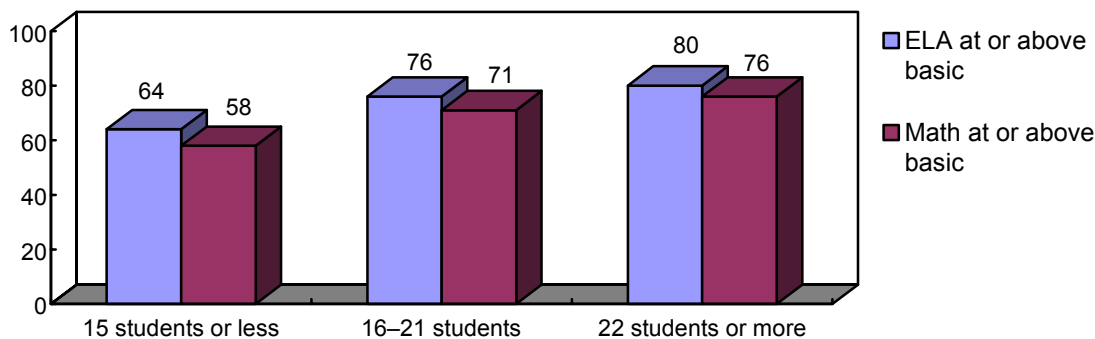


Figure 20. Percentage of students scoring at or above basic on the grade three PACT by class size, spring 2000 (n=23,002).

9. What are the student performance gaps on the third-grade PACT between large and small classes by ethnicity and free- or reduced-price lunch eligibility? (Statewide data, spring 1999 and spring 2000.)

As shown in figure 21, the scaled score mean differences between whites and nonwhites on the third-grade PACT were narrower in small classes on both ELA and math across both school years.

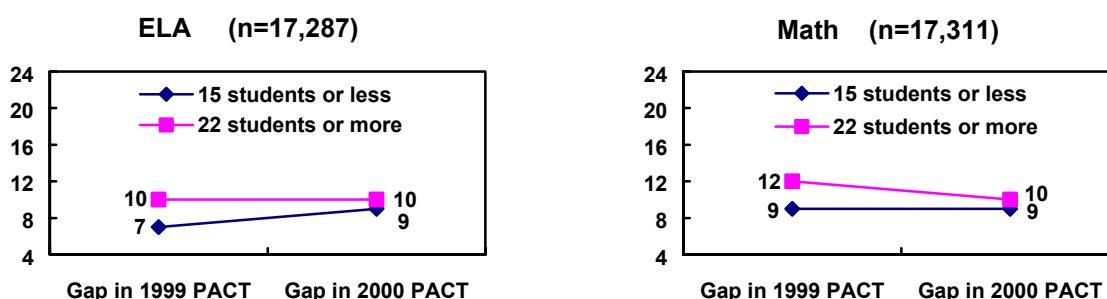


Figure 21. Student performance gaps on the third-grade PACT in large and small classes between white and nonwhite students, spring 1999 and spring 2000.

Student performance gaps between students eligible for the free- or reduced-price lunch program and those who were not are narrower in small classes. This occurred for both ELA and math across both years (see figure 22).

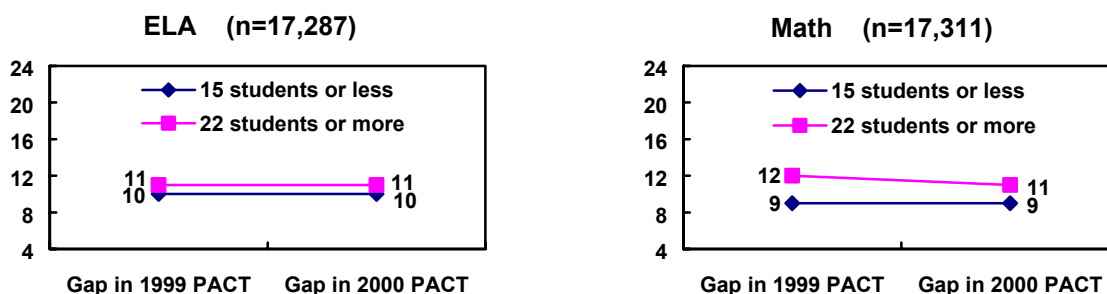


Figure 22. Student performance gaps on the third-grade PACT in large and small classes between students eligible for the free- or reduced-price lunch program and students not eligible, spring 1999 and spring 2000.

Local Implementation

District-level analyses of third-grade student performance on the PACT showed that seventeen school districts in 1999 and fourteen in 2000 had students from smaller classes achieve higher average scores than the students in the larger classes. Telephone interviews with the directors of elementary education in these districts were conducted to obtain information about CSR implementation practices. The researchers posed the following questions in order to determine specific implementation issues:

- When did your district receive funds for CSR and where did the funds come from?
- What are the goals of CSR in your district?
- Did your district hire more teachers for CSR? If yes, how many teachers were hired using CSR funds?
- What are the methods for student assignment to small classes?
- Did your district conduct teacher professional development activities related to CSR? If yes, what were they?
- What were the instructional strategies used in small classes?

Analysis of the interview responses revealed that CSR varies considerably from district to district in terms of funding sources, student assignment to reduced-size classes, classroom instructional strategies, and professional development activities for teachers.

Funding Sources for CSR

- Federal Class-Size Reduction Program, K–3
- State EAA funds to reduce class size in grades one through three
- Federal Title I program
- State EIA, Act 135 funds
- Local funds

Students' Assignment to Small Classes

- About 30 percent of districts interviewed had assigned the students at greatest risk to small classes.
- More than half (53 percent) of the districts had randomly assigned students to small classes.
- The rest of the districts (17 percent) had used more than one method to assign students to small classes.

Classroom Instructional Strategies

- Hands-on math
- Pat Cunningham's four-blocks literacy model for reading
- Thinking maps
- Reading Recovery
- Writing across content areas
- Cooperative learning

Teacher Professional Development

- Teacher training in early childhood education
- Classroom management training

Local CSR Implementation Challenges

- Adequate funding for teacher salaries and classroom space
- Equity issues when all primary classes cannot be reduced to 15:1
- Lack of state guidelines for implementing CSR

Most of the districts interviewed (65 percent) tracked students in small classes from grade one to grade three. Approximately sixty-two teachers were hired using CSR funds across the districts interviewed.

Conclusions and Recommendations

On the basis of the evidence from numerous research studies evaluating the effectiveness of class size reduction and an analysis of student demographic information and achievement performance in South Carolina, the following conclusions and recommendations are presented.

Conclusions

- Since the implementation of CSR funding, many more students are being served in small classes. The increases are particularly dramatic for first-grade enrollment. While students eligible for free- and reduced-price lunch are to be given priority for small class assignment, statewide data also show an increase in CSR participation for those students who were not eligible.
- First-grade students from small classes in the limited sample of nine school districts performed better in reading and math on the MAT-7 than students in medium-sized or large classes. These results were consistent across demographic breakdowns for gender, ethnicity, and free- or reduced-price lunch eligibility. Published research shows that effects are most pronounced when CSR is implemented in the first years of a child's education (Achilles, 1997; Finn, 1998; Finn & Achilles, 1990; Finn & Achilles, 1999; Robinson, 1990).
- Students who had been in small classes in the first grade performed better on the second-grade MAT-7 in reading and math. They had higher mean scores than students from medium-sized or large classes.
- While all second-grade students in the limited sample increased their MAT-7 average scaled scores from first to second grade, the students who were enrolled in the smallest-sized classes for both first and second grade had larger gains than students who were enrolled in the largest-sized classes for first and second grade.
- In the limited sample, the performance on the MAT-7 by those students who were in small classes only during the second grade shows that they derived no benefit from being in small classes. In fact, students from medium-sized classes had the highest mean scores on the second-grade MAT-7. Two major exceptions should be noted: minority students and students eligible for the free- or reduced-price lunch program achieved higher math mean scores in small classes.
- Statewide PACT performance in grade three favored students from large classes. However, these preliminary results may have been impacted by a host of factors beyond class size, including the following:
 - ⇒ There was no information available detailing teacher qualifications, curriculum resources, or instructional strategies. These factors have a much stronger impact on student achievement than class size. In fact, in their 1999 report Finn and Achilles conclude that teacher quality explains most differences in student performance.

- ⇒ Other researchers have found that achievement gains are not long lasting unless students have been in small classes for three to four years (Finn, Gerber, Achilles, & Boyd-Zaharias, 2000; Nye & Hedges, 1999; Slavin, 1989).
- ⇒ There are major differences in test content and format between the MAT-7 (a norm-referenced test) and the PACT (a criterion-referenced test). A more appropriate assessment instrument for early childhood may yield different results and would be more in line with South Carolina's curriculum standards.
- ⇒ Most importantly, the students in small classes in South Carolina were overrepresentative of low-income, at-risk students, whose achievement performance is traditionally low.
- An examination of achievement score gaps between white and nonwhite students and between students who are eligible for free- or reduced-price lunch and those who are not reveals that small class size works to lessen performance differences between these groups. These results are widely supported by published research indicating that smaller class size helps to reduce the achievement gap between whites and nonwhites as well as improving achievement for low income students (CERAIO, 2000; Finn, 1998; Finn & Achilles, 1990; Finn & Achilles, 1999; Mosteller, 1995; Robinson, 1990; Robinson & Wittebols, 1986).

Recommendations

- The Education Accountability Act states, "The Department of Education . . . will develop a plan for evaluating the impact of this initiative [CSR] and report to the Education Oversight Committee no later than December 1, 2001" (S.C. Code Ann. § 59-63-65). Careful examination of the research reveals support for the thesis that class size reduction improves achievement test scores in the primary grades. Preliminary analyses of a limited number of self-selected school districts in South Carolina shows gains in student achievement in grade one and on into grade two for students who had been in small classes for two years.

In addition to the impact on achievement, there are substantial benefits from CSR related to student and teacher behavior. Students participated more in class, were more engaged, spent more time on-task, and exhibited improved behavior (Bain & Achilles, 1986; CERAIO, 2000; Finn, 1998; Molnar et al., 1999; Word et al., 1990). Benefits to teachers were related to their having more time for efforts beyond classroom management. Those who taught small classes had more time to provide individualized instruction to address individual students' strengths and weaknesses. They were also able to supplement and enrich instruction as well as to spend more time on review and practice of basic skills (Bain & Achilles, 1986; CERAIO, 2000; Finn & Achilles, 1999; Molnar et al., 1999; Word et al., 1990).

Further evidence from research by Boyd-Zaharias and Pate-Bain (2000) point to changes in student attitude toward and motivation for learning. The researchers found that students who had been in small classes in the primary grades had higher grade point averages in high school, took more challenging coursework, and were more likely to go on to college. Additional benefits were decreases in the number of students retained in their current grade

and early identification of special education needs (Finn & Achilles, 1999; Achilles, 1997; Achilles, Nye, Zaharias, & Fulton, 1996).

- If the Education Oversight Committee or the General Assembly decides that a comprehensive evaluation of CSR initiatives should be conducted, a number of confounding variables would need to be controlled: teacher quality, instructional strategies, curriculum resources, and student demographic characteristics and selection criteria.
- CSR efforts should be focused in the primary grades (kindergarten through grade two), where benefits have been found consistently in the research (Achilles, 1997; Finn, 1998; Finn & Achilles, 1990; Finn & Achilles, 1999; Robinson, 1990). Efforts should also be concentrated on schools and students who are at greatest risk: minorities and low-income students. Targeting funding efforts in this direction will help to reduce the historical achievement gaps between these groups of students and those not at risk.
- Clear and comprehensive guidelines must be developed to assist schools with CSR implementation. Professional development for teachers should be focused on effective approaches for impacting student learning in small classrooms.

References

- Achilles, C. M. (1997). Small classes, big possibilities. *School Administrator*, 54(9), 6–9, 12–13, 15.
- Achilles, C. M., Nye, B. A., Zaharias, J. B., & Fulton, B. D. (1996, March). *Education's equivalent of medicine's Framingham heart study*. Paper presented at the annual National Conference on Creating the Quality School, Oklahoma City, OK.
- Bain, H. P., & Achilles, C. M. (1986). Interesting developments on class size. *Phi Delta Kappan*, 67(9), 662–665.
- Betts, J. R., & Shkolnik, J. L. (1999). The behavioral effects of variations in class size: The case of math teachers. *Educational Evaluation and Policy Analysis*, 21(2), 193–213.
- Boyd-Zaharias, J., & Pate-Bain, H. (2000, April). *The continuing impact of elementary small classes*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.
- Bracey, G. (1999). *Distortion and disinformation about class size reduction: It borders on the criminally irresponsible*. Education Disinformation Detection and Reporting Agency. Retrieved September 15, 2001, from www.america-tomorrow.com/bracey/EDDRA/EDDRA4.htm.
- CERAIO (Center for Education Research, Analysis, and Innovation). (2000, December). *1999–2000 results of the Student Achievement Guarantee in Education (SAGE) program evaluation: Executive summary*. Milwaukee: School of Education, University of Wisconsin-Milwaukee.
- Ellis, T. I. (1984). Class size. *ERIC Digest* (11). Eugene, OR: ERIC Clearinghouse on Educational Management. (ERIC Document Reproduction Service No. ED259454.)
- ERIC Clearinghouse on Educational Management (2000, Spring). Class-size-reduction initiatives, by state. In *Policy Report* (pp. 14–15). Eugene, OR: Author.
- Finn, J. D. (1998, April). *Class size and students at risk: What is known? What is next?* A commissioned paper from the National Institute on the Education of At-Risk Students. Washington, DC: Office of Educational Research and Improvement, U.S. Department of Education.
- Finn, J. D., & Achilles, C. M. (1990, Fall). Answers and questions about class size: A statewide experiment. *American Educational Research Journal*, 27(3), 557–577.
- Finn, J. D., & Achilles, C. M. (1999). Tennessee's class size study: Findings, implications, misconceptions. *Educational Evaluation and Policy Analysis*, 21(2), 97–110.
- Finn, J. D., Fulton, B. D., Zaharias, J. B., & Nye, B. A. (1989). Carry-over effects of small classes. *The Peabody Journal of Education*, 67(1), 75–84.

- Finn, J. D., Gerber, S. B., Achilles C. M., & Boyd-Zaharias, J. B. (2000, April). *The enduring effects of small classes*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.
- Gilman, D., & Tillitski, C. (1989). *The longitudinal effects of smaller classes: Four studies*. Terre Haute: Indiana State University.
- Glass, G. V., Cahen, L. S., Smith, M. L., & Filby, N. N. (1982). *School class size: Research and policy*. Beverly Hills, CA: Sage.
- Glass, G. V., & Smith, M. L. (1979). Meta-analysis of research on the relationship of class size and achievement. *Educational Evaluation and Policy Analysis*, 1(1), 2–16.
- Hanushek, E. A. (1999). Some findings from an independent investigation of the Tennessee STAR experiment and from other investigations of class size effects. *Educational Evaluation and Policy Analysis*, 21(2), 143–163.
- Harvey, B. H. (1994). *The effect of class size on achievement and retention in the primary grades: Implications for policy makers*. Paper presented at the annual meeting of the North Carolina Association for Research in Education (NCARE), Greensboro, NC.
- Illig, D. C. (1996, June). *Reducing class size: A review of the literature and options for consideration*. Paper prepared at the request of Senator Lucy Killea. Retrieved January 2, 1998 from <http://www.library.ca.gov/CRB/clssz/index.html>.
- Mitchell, D. E., Beach, S. A., & Badarak, G. (1989). Modeling the relationship between achievement and class size: A re-analysis of the Tennessee project STAR data. *Peabody Journal of Education*, 67(1), 34–74.
- Molnar, A., Smith, P., Zahorik, J., Palmer, A., Halbach, A., & Ehrle, K. (1999). Evaluating the SAGE program: A pilot program in targeted pupil-teacher reduction in Wisconsin. *Educational Evaluation and Policy Analysis*, 21 (2), 165–177.
- Mosteller, F. (1995, Summer/Fall). The Tennessee study of class size in the early school grades. *The Future of Children: Critical Issues for Children and Youths*, 5(2), 113–127.
- NAEYC (National Association for the Education of Young Children). (1987). *Standardized testing of young children 3 through 8 years of age*. Washington, DC: Author.
- Nye, B., & Hedges, L. V. (1999). The long-term effects of small classes: A five-year follow-up of the Tennessee class size experiment. *Educational Evaluation and Policy Analysis*, 21(2), 127–142.
- Public Schools of North Carolina. (1999, August). Update on class size research since 1998. *Evaluation Brief*, 2(6), 1–10.
- Robinson, G. E. (1990, April). Synthesis of research on the effects of class size. *Educational Leadership*, 47(7), 80–90.

- Robinson, G., & Wittebols, J. H. (1986). *Class size research: A related cluster analysis for decision making*. Arlington, VA: Educational Research Service.
- Sanogo, Y., & Gilman, D. (1994). *Class size and student achievement: Tennessee's STAR and Indiana's prime time projects*. Terre Haute: Indiana State University.
- Shapson, S. M., Wright, E. N., Eason, G., & Fitzgerald, J. (1980). An experimental study of effects of class size. *American Educational Research Journal*, 17(2), 141–152.
- Slavin, R. E. (1986, Fall). Best evidence synthesis: An alternative to meta-analysis and traditional reviews. *Educational Researcher*, 15(9), 5–11.
- Slavin, R. E. (Ed.). (1989). *School and classroom organization*. Hillside, NJ: Erlbaum.
- Smith, M. L., & Glass, G. V. (1980). Meta-analysis of research on class size and its relationship to attitudes and instruction. *American Educational Research Journal*, 17(4), 419–433.
- United States Department of Education. (2000, September). *The class-size reduction program: Boosting student achievement in schools across the nation, a first-year report*. Washington, DC: Author.
- Word, E., Achilles, C. M., Bain, H. P., Folger, J., Johnston, J., & Lintz, M. N. (1990). *Project STAR final executive summary report: Kindergarten through third grade (1985–1989)*. Nashville: Tennessee State Department of Education.

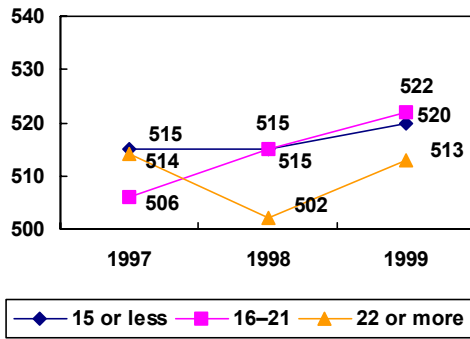
Appendix

MAT-7 Performance by Class Size, 1997–99 Data for Nine Districts

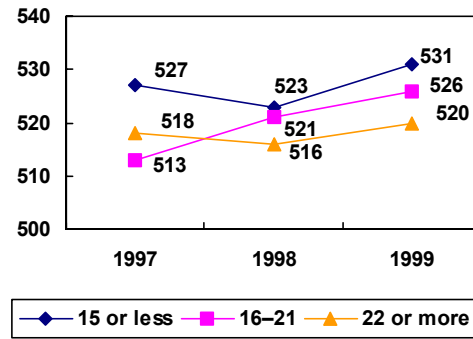
Number of Students: 1997=7,209; 1998=8,864; 1999=6,573

GRADE 1

Reading

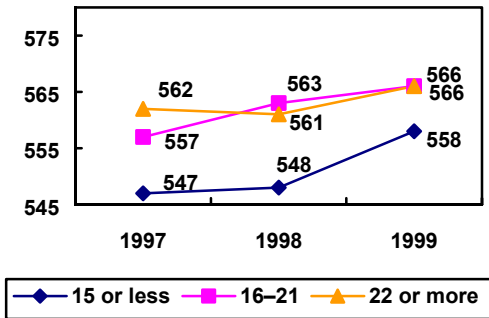


Math

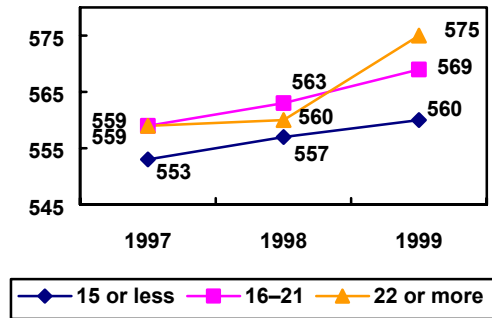


GRADE 2

Reading

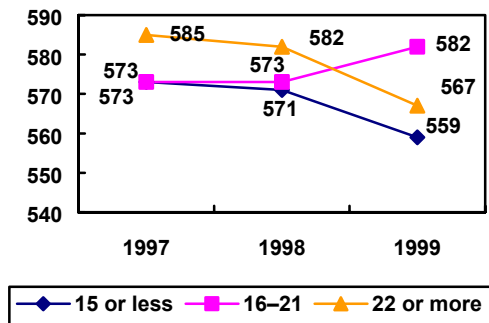


Math

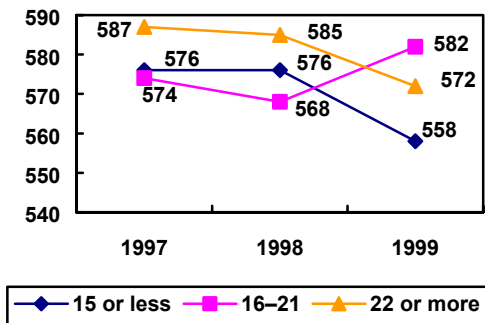


GRADE 3

Reading



Math



Note: First-grade students from small classes scored significantly higher on the MAT-7 reading and math than students from large classes after the school readiness scores (CSAB) were adjusted in each of the three years. Results from statistical analyses are available upon request from the Evaluation Section, Office of Research, State Department of Education.